CHAPTER 6
STRUCTURAL STEEL

SIFC-601 GENERAL

SIFC-601.1 Scope. The requirements of this chapter and IBC-1704.3 shall apply when construction includes structural hot-rolled steel building elements as listed in SIFC-302.2. Where required, structural hot-rolled steel building elements shall also comply with IBC-1705, IBC-1707 and IBC-1708. See SIFC-2000 Chapter 14 for sprayed fire-resistant materials.

SIFC-601.2 Steel fabrication. Structural steel fabricators shall be subject to special inspections as required by SIFC-302.1 and SIFC-603 and IBC-1704.2.

SIFC-601.3 Steel erection. Structural steel elements shall be subject to special inspections as required by SIFC-604. Construction shall conform to the AISC Code of Standard Practice. Adequate guying and/or bracing shall be used during the erection process to maintain the stability of the structure. Structural steel, joists, etc. shall not be erected on concrete or masonry footings, piers, walls, etc. less than 7 days old or less than 75% strength (concrete f'_c or masonry f'_m) unless the concrete or masonry strength criteria that have been established by the **SER** for carrying such loads are satisfied.

SIFC-602 FABRICATION AND ERECTION DOCUMENTS

SIFC-602.1 Review and approval. The structural steel fabrication and erection documents shall be submitted for review and approval to the **SER** and to **FCCSS** prior to fabrication and erection of steel elements. The **GC** shall submit two sets of **SER-**approved fabrication and erection documents to **FCCSS** for approval. After County review and approval, **FCCSS** will return one set of County-approved fabrication and erection documents for use on the job site. County-approved documents shall be used by the **SIER** to conduct special inspections during construction.

SIFC-602.2 Preparation of fabrication and erection documents. The structural steel fabrication and erection documents shall include designs and details for welded and bolted connections. Details for welded connections shall clearly indicate the seismic-force-resisting elements of buildings of Seismic Category C. Details for bolted connections shall clearly indicate the type of connection used in the design (bearing or slip-critical), the amount of tensioning required (snug tight or fully tensioned) and the ASTM specifications for the bolts, nuts and washers.

SIFC-602.3 SER review and approval. The structural steel fabrication and erection documents shall be reviewed and approved by the **SER** in accordance with the following requirements:

a. Review and approval stamp. Each fabrication and erection document shall bear the review and approval stamp of the **SER** or be otherwise individually identified as being reviewed and approved (see SIFC-103).

b. Primary structural system. The **SER** shall review and approve the submitted documents for compliance with County-approved construction documents, including the review and approval of any connections developed by the steel fabricator. The **SER** shall indicate

approval with a signed and sealed statement, attached to the documents, accepting responsibility for the design of connections which shall include language as given in either:

> "The structural steel fabrication and erection documents have been reviewed, including a verification of all the structural steel connections shown. Where marked "Approved" or "Approved as Noted", I accept full responsibility for the design of the connections to support the design loads required by the County-approved construction documents for the completed project."

or

> "I have reviewed the structural steel fabrication and erection documents *(list)* as prepared by *(company)* for the above referenced project. My review and approval, or approval as noted, dated *(date)*, included a verification of all the structural steel connections shown. I accept the responsibility for the design of the connections to support the design loads required by the County-approved construction documents for the completed project."

c. Secondary structural elements. Secondary structural elements are required to be reviewed and approved by the **SER** only for their effects on the primary structural system.

SIFC-603 INSPECTION OF STEEL FABRICATORS

SIFC-603.1 Steel fabricators. The **SIER** shall provide special inspection of the steel fabricator and fabrication procedures, and of the fabricated items, as required by IBC-1704.2 (see SIFC-302.1).

SIFC-603.2 Fabrication procedures.

a. Certification. The fabricator may demonstrate to the **SIER** that the requirements of IBC-1704.2 have been met by furnishing evidence of compliance with the AISC Quality Certification Program in the appropriate category.

b. Procedures implementation. The **SIER** shall verify in writing to **FCCSS** that the fabricator is properly implementing the fabrication and quality control procedures outlined above. Verification may be on a job basis or by inspection within the previous twelve months.

SIFC-604 INSPECTION OF STEEL ELEMENTS

SIFC-604.1 Material receiving. The **SIER** shall inspect steel elements, welding material, and high strength bolts for conformance with IBC-Table 1704.3. High strength bolts and nuts shall be clearly marked with an identifiable manufacturer's mark on both the bolt head and nut. All shipments of high-strength bolts, nuts, and washers, whether from manufacturer, distributor, or reseller, shall include manufacturer's current test reports for chemical composition (ASTM A 751) and mechanical properties, including proof load testing (ASTM F 606).

SIFC-604.2 Steel elements. The **SIER** shall inspect steel elements in accordance with IBC-1704.3.

> **IBC-1704.3 Steel construction.** The special inspections for steel elements of buildings and structures shall be as required by Section 1704.3 and Table 1704.3. Where required, special inspection of steel shall also comply with Section 1715.

Exceptions:
1. Special inspection of the steel fabrication process shall not be required where the fabricator does not perform any welding, thermal cutting or heating operation of any kind as part of the fabrication process. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification, grade and mill test reports for the main stress-carrying elements are capable of being determined.
2. The special inspector need not be continuously present during welding of the following items, provided the materials, welding procedures and qualifications of welders are verified prior to the start of the work; periodic inspections are made of the work in progress; and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.
   2.1. Single pass fillet welds not exceeding $^{5}/_{16}$ inch (7.9 mm) in size.
   2.2. Floor and roof deck welding.
   2.3. Welded studs when used for structural diaphragm.
   2.4. Welded sheet steel for cold-formed steel framing members such as studs and joists.
   2.5. Welding of stairs and railing systems.

IBC-1704.3.1 Welding. Welding inspection shall be in compliance with AWS D1.1. The basis for welding inspector qualification shall be AWS D1.1.

IBC-1704.3.2 Details. The special inspector shall perform an inspection of the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.

IBC-1704.3.3 High-strength bolts. Installation of high strength bolts shall be periodically inspected in accordance with AISC specifications.

IBC-1704.3.3.1 General. While the work is in progress, the special inspector shall determine that the requirements for bolts, nuts, washers, and paint; bolted parts; and installation and tightening in such standards are met. For bolts requiring pretensioning, the special inspector shall observe the pre-installation testing and calibration procedures when such procedures are required by the installation method or by project plans or specification; determine that all plies of connected materials have been drawn together and properly snugged; and monitor the installation of bolts to verify that the selected procedure for installation is properly used to tighten bolts. For joints required to be tightened only to the snug tight condition, the special inspector need only verify that the connected materials have been drawn together and properly snugged.

IBC-1704.3.3.2 Periodic monitoring. Monitoring of bolt installation for pretensioning is permitted to be performed on a periodic basis when using the turn-of-nut method with matchmarking techniques, the direct tension indicator method, or the alternate design fastener (twist-off bolt) method. Joints designated as snug tight need be inspected only on a periodic basis.

IBC-1704.3.3.3 Continuous monitoring. Monitoring of bolt installation for pretensioning using the calibrated wrench method or the turn-of-nut method without matchmarking shall be performed on a continuous basis.

IBC-TABLE 1704.3
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD[a]	IBC REFERENCE
1. Material verification of high-strength bolts, nuts, and washers:		X	Applicable ASTM material specifications;	
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—		AISC ASD, Section A3.4; AISC LRFD, Section A3.3	—
b. Manufacturer's certificate of compliance required.				
2. Inspection of high-strength bolting:			AISC LRFD, Section M2.5	1704.3.3
a. Bearing-type connections.		X		
b. Slip-critical connections.	X	X		
Material verification of structural steel:				1708.4
a. Identification markings to conform to ASTM standards specified in the approved construction documents.			ASTM A 6 or ASTM A 568	
b. Manufacturers' certified mill test reports required.	—	—	ASTM A 6 or ASTM A 568	
4. Material verification of weld filler materials:				
a. Identification markings to conform to AWS specification in the approved construction documents.			AISC ASD, Section A3.6; AISC LRFD, Section A3.5	
b. Manufacturer's certificate of compliance required.	—	—		—
5. Inspection of welding:			AWS D1.1	1704.3.1
a. Structural steel:				
1) Complete and partial penetration groove welds	X			
2) Multi-pass fillet welds	X			
3) Single-pass fillet welds > $^5/_{16}$" (7.9 mm)	X			
4) Single-pass fillet welds < $^5/_{16}$" (7.9 mm)		X		
5) Floor and deck welds		X	AWS D1.3	
b. Reinforcing steel:			AWS D1.4	1704.3.1
1) Verification of weldability of reinforcing steel other than ASTM A 706.		X	ACI 318: 3.5.2	
2) Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special reinforced concrete shear walls, and shear reinforcement.	X			
3) Shear reinforcement.		X		
4) Other reinforcing steel.	X			
6. Inspection of steel frame joint details for compliance with approved construction documents:		X		1704.3.2
a. Details such as bracing and stiffening.	—		—	
b. Member locations.				
c. Application of joint details at each connection.				

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1707.1, Special inspection for seismic resistance.

SIFC-604.3 Erection. The **SIER** shall perform special inspections of anchor bolts, bolts, welding, connections, and details. Any observed discrepancies between the County-approved construction documents and the County-approved structural steel fabrication and erection documents shall be brought to the immediate attention of the **SER** and **FCCSS**. All steel elements shall be inspected before they are covered by sprayed fire-resistant materials, or are otherwise concealed.

a. High strength bolts. Installation shall conform to the County-approved construction documents, County-approved structural steel fabrication and erection documents, and the RCSC/AISC *Specification for Structural Joints Using A325 or A490 Bolts*.

In the event any bolt, nut, or washer is broken during normal installation (except bolts purposely over-torqued in order to draw the parts together), the **SIER** shall bring such failures to the immediate attention of the **SER** and **FCCSS.** The **SIER** shall observe the on-job-site proof load testing of any suspect bolt(s) per ASTM and AISC standards. Should the bolts fail load testing, they shall be rejected and the **SER** shall make recommendations in writing for remedial actions. All test results and recommendations shall be reported to **FCCSS**.

b. Welding. All welders and weld special inspectors shall be certified in accordance with AWS D1.1. Weld inspection shall be in conformance with IBC-1704.3.1 and IBC-Table 1704.3 Item 5.

c. Rigid or semi-rigid connections. When field welding of rigid or semi-rigid connections is required, or when bolted connections are required to meet a minimum pretension beyond snug tight, the **SIER** shall conduct special inspections of the connections.

d. Details: The **SIER** shall perform inspections of the steel frame to verify compliance with the details shown on the County-approved construction documents and the County-approved fabrication and erection documents, such as bracing, stiffening, member locations, and proper application of joint details at each connection.

e. Composite construction: The **SIER** shall inspect shoring for composite construction (see SIFC-702.3 and IBC-Table 1704.4 Item 11 for design and inspection requirements).

SIFC-605 COMPLETION OF STRUCTURAL STEEL CONSTRUCTION

Upon completion of structural steel construction, including connections, the **SIER** shall, after review and approval by the **SER,** submit a completion letter to **FCCSS** and shall indicate the date of completion on the final report of special inspections.